

JP 05-203,336



Job No.: 1505-101672

Ref.: 5-203336

Translated from Japanese by the Ralph McElroy Translation Company
910 West Avenue, Austin, Texas 78701 USA

BEST AVAILABLE COPY

JAPANESE PATENT OFFICE
PATENT JOURNAL (A)
KOKAI PATENT APPLICATION NO. HEI 5[1993]-203336

Int. Cl. ⁵ :	F 25 D 23/00 A 61 L 2/16 9/16 B 01 D 53/36
Sequence Nos. for Office Use:	7380-3L 8718-4C 9042-4D
Filing No.:	Hei 4[1992]-12948
Filing Date:	January 28, 1992
Publication Date:	August 10, 1993
No. of Claims:	4 (Total of 5 pages)
Examination Request:	Not filed

FREEZER/REFRIGERATOR EQUIPPED WITH DEODORIZING-ANTIBACTERIAL
DEVICE

Inventors:	Hiroshi Kikuchi Tochigi Works, Hitachi, Ltd. 800 Oaza Tomita, Ohira-cho, Shimotsuga-gun, Tochigi-ken
	Teruo Kakuta Tochigi Works, Hitachi, Ltd. 800 Oaza Tomita, Ohira-cho, Shimotsuga-gun, Tochigi-ken
	Reishi Naka Tochigi Works, Hitachi, Ltd. 800 Oaza Tomita, Ohira-cho, Shimotsuga-gun, Tochigi-ken
	Takahiro Orikasa Tochigi Works, Hitachi, Ltd.

800 Oaza Tomita, Ohira-cho,
Shimotsuga-gun, Tochigi-ken

Applicant:

000005108
Hitachi, Ltd.
4-6 Kandasurugadai, Chiyoda-ku,
Tokyo

Agent:

Toshiyuki Susukida, patent attorney

[There are no amendments to this patent.]

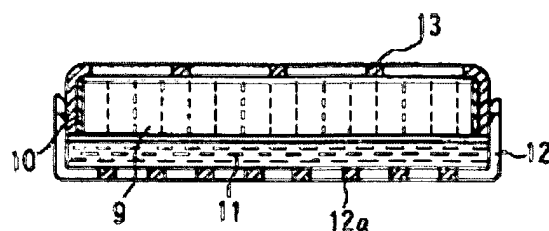
Abstract

Objective

To provide a type of freezer/refrigerator equipped with a quick connect/disconnect deodorizing-antibacterial device characterized by the fact that the mechanism is very simple, is maintenance-free for a long period of time, and is prepared by integrating a deodorizing catalyst filter and an antibacterial filter.

Constitution

A cassette-type deodorizing-antibacterial device prepared by integrating a ngan [sic; manganese] oxide based deodorizing catalyst (9) and an antibacterial filter (11) containing a silver compound, is attached in a quick connect/disconnect way at the cold air return suction port, and the flow of cold air in the refrigerator chamber is used to perform deodorizing and antibacterial treatment. Said antibacterial filter (11) may be colored. A bypass structure for the cold air is formed on the two sides of the deodorizing-antibacterial device for use in case of clogging. Also, because antibacterial filter (11) is positioned below deodorizing catalyst (9), that is, on the inner side of the refrigerator chamber, the filter acts as a receptacle if deodorizing catalyst (9) breaks and debris from the deodorizing catalyst cannot fall into the refrigerator chamber.



9---脱臭触媒フィルタ 12---下ケース
 10---脱臭触媒の緩衝用ベルト 13---上ケース
 11---抗菌フィルタ

Figure 2

Key: 9 Deodorizing catalyst filter
 10 Belt for buffering the deodorizing catalyst
 11 Antibacterial filter
 12 Lower housing
 13 Upper housing

Claims

1. A type of freezer/refrigerator equipped with a deodorizing-antibacterial device characterized by the fact that the deodorizing-antibacterial device is arranged at the cold air return suction port in the refrigerator chamber, with the deodorizing-antibacterial device being prepared from a deodorizing filter containing a transition metal element oxide as a catalyst component and an antibacterial filter containing an inorganic feed material consisting of silver or a silver compound, with said filters facing each other and combined with each other.

2. The freezer/refrigerator equipped with the deodorizing-antibacterial device described in Claim 1 characterized by the fact that said deodorizing-antibacterial device is formed as a cassette, and it is mounted at the cold air return suction port in the refrigerator chamber in a quick connect/disconnect way.

3. The freezer/refrigerator equipped with the deodorizing-antibacterial device described in Claim 1 or 2 characterized by the fact that when said deodorizing-antibacterial device is mounted in the cold air return suction port in the refrigerator chamber, its two sides form a bypass structure.

4. The freezer/refrigerator equipped with the deodorizing-antibacterial device described in any of Claims 1-3 characterized by the fact that said antibacterial filter is colored a prescribed color.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to a type of freezer/refrigerator equipped with deodorizing-antibacterial device mounted at the cold air return suction port in the refrigerator chamber.

[0002]

Prior art

In the prior art, an adsorbent mainly made of activated carbon has usually been used to remove the undesired odor component in the limited space in a refrigerator. However, the activated carbon itself has a limited adsorption capacity. In order to restore the adsorptivity, it is necessary to heat it or to irradiate it with UV light in the presence of a catalyst.

[0003]

On the other hand, in order to remove the bacteria, etc., floating in air, filters with a very fine mesh, such as those used for clean rooms, etc., have been adopted. It is difficult to adopt these for the refrigerators for home use, however, due to their high air flow resistance. Consequently, this type is not widely used in practice.

[0004]

As another scheme, an ozone generator is arranged in the air circulation path in the refrigerator to perform deodorization and sterilization in the refrigerator. For example, this scheme is described in Japanese Kokai Patent Application No. Shi 64[1989]-49873.

[0005]

Problems to be solved by the invention

When odorous foods are stored in a refrigerator, or when foods rot and break down after long storage, the odor component is always present at a certain level. Consequently, the activated carbon conventionally used as a deodorizing agent reaches its limits of adsorption and requires regeneration measures. Although methods for deodorization and sterilization inside the refrigerator have been proposed, they are not simple enough for practical application. There is a demand for development of a device that can be handled easily and has a high performance.

[0006]

The objective of the present invention is to solve the aforementioned problems of the prior art by providing a type of freezer/refrigerator equipped with deodorizing-antibacterial device with a simple structure and a high performance. As a result of extensive experimental studies, the present inventors have found that when a catalyst-based deodorizer is used in place of the activated carbon, the mechanism becomes much simpler, and it can be used for a long time without maintenance. Also, even fine dust, as well as bacteria and pollen floating in the refrigerator, can be removed with a filter with a low resistance to air flow. As a result, it is possible to keep the interior of the refrigerator clean, and to reduce the influence of microbes on stored food. Consequently, food can be stored for a long time. Because the deodorizer and antibacterial agent are integrated in the form of a cassette, it can be mounted in a variety of refrigerator models. If the deodorizing catalyst breaks, the antibacterial filter can act as a receptacle. The present invention was developed on the basis of the knowledge obtained in these experimental studies.

[0007]

Means to solve the problems

In the following, the knowledge derived from the experimental studies by the present inventors will be specifically explained. Studies indicate that the odor components in refrigerators mainly consist of sulfur-based gases, especially methyl mercaptan, as the principal component. When methyl mercaptan contacts the manganese-based catalyst in a transition metal oxide, a dehydrogenation reaction takes place so that it is converted to dimethyl sulfide that is less odorous. Consequently, when the manganese catalyst is formed in, for example, a honeycomb shape to ensure good contact with air and, the air in the refrigerator is passed through it, long-term high-efficiency deodorization becomes possible. Also, taking into consideration the fact that bacteria and pollen in the atmosphere are enclosed in dust and dirt and float, if a filter shaped to ensure good air contact and containing a silver compound is set in the air flow path in the refrigerator, the antibacterial property of the silver compound kills the bacteria caught on the filter. Materials for such filters include nonwoven fabrics made of polyester or other synthetic fibers, as well as silica- and alumina-based ceramics, etc. By adjusting the mesh size of the nonwoven fabric, it is possible to ensure air flow through the fine holes in the filter. Even if the deodorizing catalyst is broken, the filter can act as a receptacle to prevent debris from the deodorizing catalyst from scattering into the refrigerator chamber. In combination with said deodorizing filter, both deodorization and sterilization become possible at the same time.

[0008]

In addition, because silver or silver compound is used as the antibacterial filter, it is possible to avoid discoloration, a problem of the filter, due to reaction with sulfide gas [sic; hydrogen sulfide gas], UV light, etc. By coloring the filter black or brown color beforehand, it is possible to limit color change to a certain degree. In addition, in order to avoid clogging of the cassette type deodorizing-antibacterial device, a bypass is formed on the two sides of the deodorizing-antibacterial device. As a result, it is possible to solve the problem of insufficient cooling of the interior of the refrigerator.

[0009]

In the following, the means for realizing the objective of the present invention will be explained in more detail. The present invention provides a type of freezer/refrigerator equipped with a deodorizing-antibacterial device characterized by the fact that the deodorizing-antibacterial device is mounted at the cold air return suction port in the refrigerator chamber, with the deodorizing-antibacterial device being prepared from a deodorizing filter carrying transition metal oxide as a catalyst component and an antibacterial filter carrying an inorganic feed material containing silver or silver compound, with said filters facing each other and combined with each other.

[0010]

Examples of the aforementioned transition metal elements include Mn, Fe, Co, Ni, Cu, Cr, Pd, Pt, etc. It is preferred for said deodorizing-antibacterial device to be formed as a cassette, and for it to be mounted in a quick connected/disconnected manner in the cold air return suction port in the refrigerator chamber. Also, when said deodorizing-antibacterial device is installed in the cold air return suction port in the refrigerator chamber, it is preferred that its two sides form a bypass structure.

[0011]

Because said antibacterial filter carries silver and silver compounds, there can be a discoloration problem. This problem, however, can be prevented by pre-coloring it to black, red, brown, grey, or the like to limit color change.

[0012]

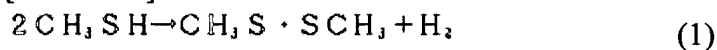
Operation

In the following, the operation when manganese is used as a typical example of the transition metal oxide used to form said deodorizing filter will be explained. The manganese

compound is mainly composed of the oxide MnO and MnO₂, and it works well as a deodorizing catalyst. That is, the manganese compound or its mixture with iron oxide and copper oxide is blended with zeolite, silica, or alumina, followed by fabrication into a porous ceramic filter. When this contacts the atmosphere in the refrigerator, methyl mercaptan, as the principal odor component, as well as hydrogen sulfide undergo the chemical changes indicated by following formulas (1), (2), and are respectively changed to dimethyl sulfide and sulfur. As a result, the odor level can be lowered significantly.

[0013]

[Formula 1]



[0014]

[Structure 2]



On the other hand, the antibacterial function of the silver and silver compounds used as the antibacterial filter has been well known for many years. For example, when silver is substituted for a portion of the sodium of a porous substance made mainly of zeolite or other oxides of silicon, aluminum, sodium, etc., the antibacterial property is further increased. Taking this fact into consideration, when the filter made of silver-containing ceramics and nonwoven fabric is mounted in the cold air return suction port in the refrigerator chamber, dust and dirt containing bacteria and pollen are caught by the filter, and these microbes die over time. According to one theory, the microbes die due to the electrochemical action between the silver ions and microbes. According to another theory, silver ions bond to the protein in the cells of the microbes to hamper growth of the microbes. Because the antibacterial filter carries silver and silver compounds, it discolours due to sulfide gas [sic; hydrogen sulfide gas], an intrinsic property of silver, and exposure to UV light. This discoloration does not harm the performance of the filter. However, its appearance can cause the problem of misleading the user. Consequently, it is colored beforehand with pigments to achieve a prescribed color such as black, red, brown, grey, etc., so that the color change can be minimized.

[0015]

The aforementioned cassette type filter prepared by integrating said deodorizing filter and antibacterial filter can be handled easily, and it can be installed in a quick connect/disconnect way at the cold air return suction port in the refrigerator chamber. Even if the deodorizing

catalyst is broken by some stress, debris can be prevented from flying into the refrigerator chamber because the antibacterial filter acts as a receptacle.

[0016]

Also, even if said cassette-type deodorizing-antibacterial device is subject to clogging, there is no problem of insufficient cooling of the interior of the refrigerator chamber since the two sides of the device have a bypass structure for the cold air.

[0017]

Application example

In the following, an application example of the present invention will be explained with reference to figures. Figure 1 is a lateral cross section of a freezer/refrigerator equipped with a deodorizing-antibacterial device. (1) represents the freezer/refrigerator; (2) represents a freezer chamber; (4) represents a refrigerator chamber; (3) represents the door of the freezer chamber; (5) represents the door of the refrigerator chamber; (6) represents a fan for circulating the cold air; (7) represents the fan motor; (8) represents an evaporator; and the region labeled A indicates the cold air return suction port.

[0018]

Figure 2 is an enlarged cross section of the cassette type deodorizing-antibacterial device installed in said A region shown in Figure 1. (9) is a manganese-based deodorizing catalyst that forms the deodorizing filter. The catalyst used in the oxidation or dehydrogenation reaction consists of a manganese compound, or a mixture of the manganese compound with iron oxide and copper oxide, is mixed with, for example, zeolite, silica, or alumina, followed by formation of a honeycomb-shaped porous ceramic filter. When this catalyst makes contact with the atmosphere in the refrigerator chamber, methyl mercaptan and hydrogen sulfide gas as the main components of the odor undergo the chemical changes shown in said formulas (1) and (2), and are converted to dimethyl sulfide and sulfur, respectively, with a significant decrease in the odor level. (10) represents a buffer belt for protecting the outside of the honeycomb-shaped manganese-based catalyst. For example, soft malt plane or the like can be used as the material for this protective member. (11) represents an antibacterial filter carrying silver and silver compounds. The antibacterial property is even higher when silver is substituted for a portion of the sodium of zeolite or another porous substance made mainly of oxides of silicon, aluminum, sodium, etc. When dust and dust containing pollen, bacteria and mold spores become attached to silver-containing antibacterial filter (11), the microbes die over time. (12) represents a lower housing of the cassette of the deodorizing-antibacterial device. (13) represents the upper housing

of the cassette of the deodorizing-antibacterial device. Manganese-based deodorizing catalyst (9) and antibacterial filter (11) are sandwiched between said lower housing (12a) and the upper housing to form a cassette type deodorizing-antibacterial device.

[0019]

Figure 3 is a plan view from the lower side illustrating how the deodorizing-antibacterial device is mounted in the cold air return suction port at region A shown in Figure 1. (12b) represents the lower housing of the cassette type deodorizing-antibacterial device; (14) represents the outer frame of the cold air return suction port; (15) represents the cold air return bypass. Also, the two sides of the cassette type deodorizing-antibacterial device form a bypass, so that even when clogging occurs for various reasons in the deodorizing-antibacterial device, the cold air flows through bypass (15), and there is no problem of insufficient cooling of refrigerator chamber (4).

[0020]

Figure 4 is an oblique view of the appearance of antibacterial filter (11). Antibacterial filter (11) is formed from nonwoven fabric made polyester or other synthetic fibers, or from silica- or alumina-based ceramics in practical application. Taking into consideration the cooling ability of refrigerator chamber (4) (when the density is very high, the flow resistance rises and the cooling ability falls just as in the case of clogging) and the need to keep a damage deodorizing catalyst (9) from falling down into refrigerator chamber (4), the mesh size of antibacterial filter (11) is adjusted to $170 \pm 30 \text{ g/m}^2$. Also, taking into consideration discoloration of the silver and silver compounds carried on antibacterial filter (11), due to sulfide gas and UV light, the filter is pre-colored to black, brown, red, grey or another prescribed color to limit discoloration to a certain degree.

[0021]

Figures 5 and 6 as diagrams illustrating the characteristics found by testing the deodorizing-antibacterial performance when the deodorizing-antibacterial device of this application example was installed in the cold air return suction port of the refrigerator chamber. For purposes of comparison, the operating results in the prior art without using said deodorizing-antibacterial device are also shown here. That is, these figures illustrate the deodorizing-antibacterial performance for methyl mercaptan and floating bacteria. As can be seen from Figure 6, more than 95% of the methyl mercaptan can be removed within 20 min. From Figure 5, it can be seen that there is about a 50% reduction in floating bacteria after 1 day. Consequently, a clean refrigerator free of bacteria and undesirable odors can be realized.

[0022]

Effects of the invention

As explained above, the aforementioned objectives can be realized by means of the present invention, which consists of an integrated cassette-type deodorizing-antibacterial device, with the antibacterial filter arranged on the side of the cassette type filter facing the refrigerator. Consequently, even if the deodorizing catalyst is broken by some force, the antibacterial filter acts as a receptacle so that no debris can fall into the refrigerator chamber. In addition, since the antibacterial filter is pre-colored to a black, brown, red, or grey color, it is possible to prevent discoloration to a certain degree, and the user does not receive a negative impression of a discolored filter.

[0023]

Also, the structure comprises a bypass on the two sides of the filter installed at the cold air return suction port in the refrigerator chamber, so that even if the filter clogs so that the air cannot flow, the bypass prevents insufficient cooling of the refrigerator chamber, so that food can be stored at a consistent temperature. In addition, combining the cassette-type deodorizing-antibacterial device with a fan allows the system to be used in various applications other than in refrigerator chambers.

Brief description of the figures

Figure 1 is a cross section of the main portion of the refrigerator chamber with an application example of the deodorizing-antibacterial device of the present invention installed in it.

Figure 2 is a cross section illustrating the constitution of the deodorizing-antibacterial device with a cassette-type constitution.

Figure 3 is a plan view of the deodorizing-antibacterial device installed in the cold air return suction port of the refrigerator chamber, as seen from the refrigerator chamber.

Figure 4 is an oblique view illustrating the appearance of the antibacterial filter installed in said deodorizing-antibacterial device.

Figure 5 is a diagram illustrating the characteristics found by testing the antibacterial performance when said deodorizing-antibacterial device was installed in the cold air return suction port.

Figure 6 is a diagram illustrating the characteristics found by testing the deodorization performance when said deodorizing-antibacterial device was installed in the cold air return suction port.

Explanation of symbols

- 1 Freezer/refrigerator
- 2 Freezer chamber
- 3 Door of freezer chamber
- 4 Refrigerator chamber
- 5 Door of refrigerator chamber
- 6 Fan
- 7 Motor of fan
- 8 Evaporator
- 9 Deodorizing catalyst filter
- 10 Buffer belt for the deodorizing catalyst
- 11 Antibacterial filter
- 12 Cassette lower housing
- 13 Cassette upper housing
- 14 Cold air return suction port
- 15 Cold air return bypass

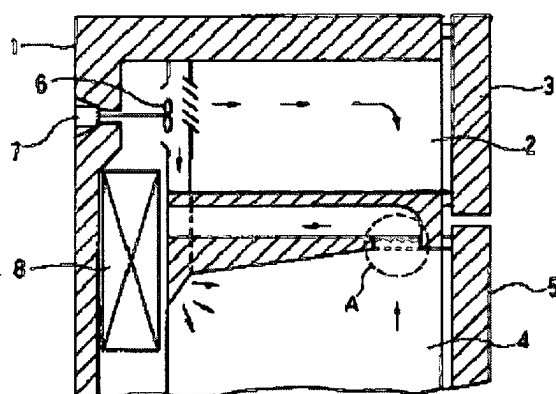
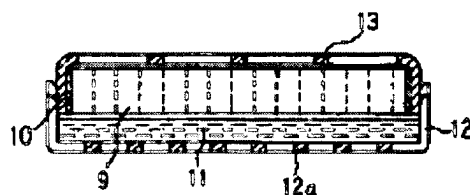


Figure 1



- 9...脱臭触媒フィルタ
- 10...脱臭触媒の緩衝ベルト
- 11...抗菌フィルタ
- 12...下ケース
- 13...上ケース

Figure 2

- Key: 9 Deodorizing catalyst filter
 10 Buffer belt for the deodorizing catalyst
 11 Antibacterial filter
 12 Lower housing
 13 Upper housing

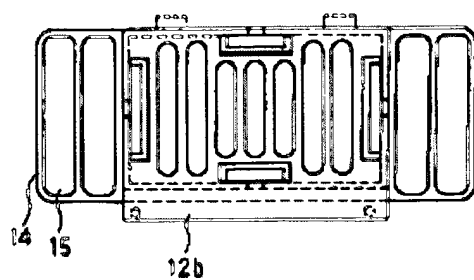


Figure 3

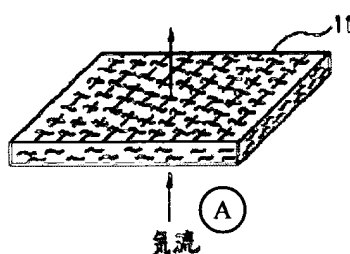


Figure 4

- Key: A Air flow

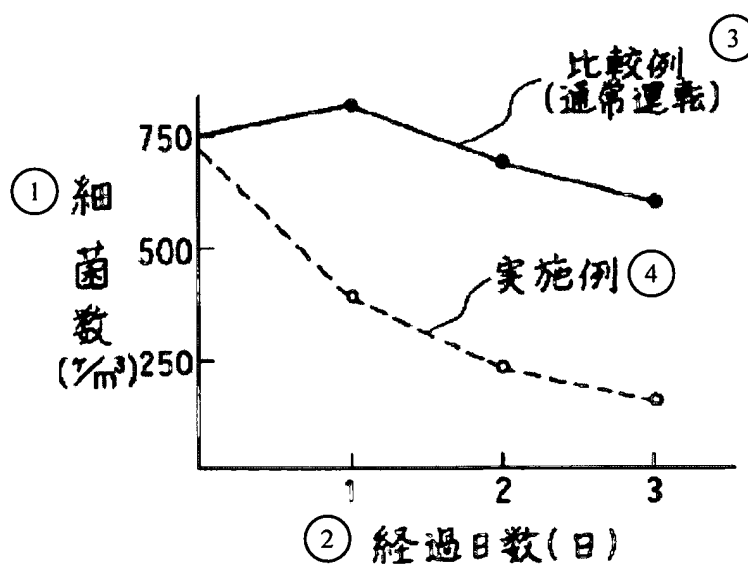


Figure 5

- Key: 1 Bacteria count (number/m³)

- 2 Time (days)
 3 Comparative example (conventional operation)
 4 Application example

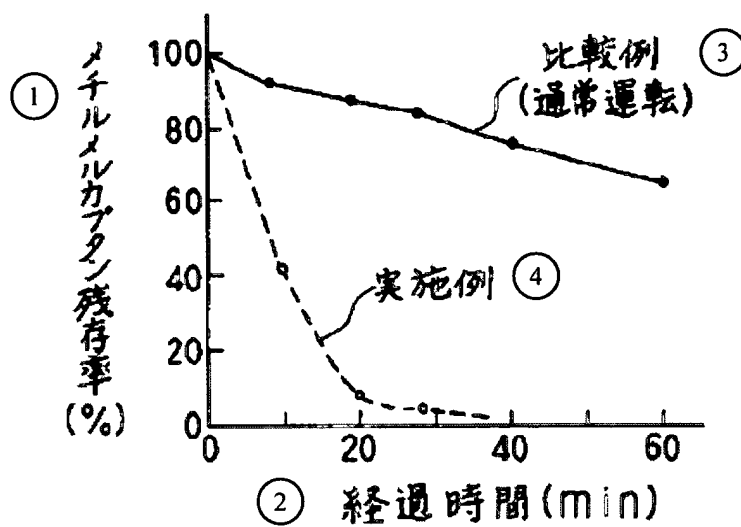


Figure 6

- Key: 1 Amount of residual methyl mercaptan (%)
 2 Time (days)
 3 Comparative example (conventional operation)
 4 Application example

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.